PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

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November 14.

SIR WM. R. HAMILTON, LL.D., President, in the Chair.

The Secretary read a paper by Sir David Brewster, "on the Compensations of Polarized Light, with a description of a Polarimeter for measuring Degrees of Polarization."

The author first directed attention to the difference of opinion between him and most other philosophers, as to the constitution of partially polarized light; it being generally supposed that such light is a mixture of common light and perfectly polarized light, whilst he considers that the entire quantity of light undergoes a physical change by approximating more or less to the condition of light completely polarized. Upon this view he had long since explained the laws of polarization discovered by himself, but he had been anxious to obtain experimental evidence capable of deciding between the two ideas, and in this he considers that he is now successful.

By means of experiments,—described in the paper,—the author points out that when two portions of light oppositely polarized compensate each other, the proportions and conditions necessary are not those which could result from mixtures of common light with fully polarized light, and hence infers that the pencils must be wholly in different physical conditions. These experiments led him to the invention of

an instrument termed the *Compensating Rhomb*, by means of which he considers decisive evidence of the correctness of his views has been obtained.

In order to determine if this principle be general, and to ascertain the laws of the compensation of polarized light, Sir David Brewster constructed an instrument for measuring the degrees of polarization. This he calls a *Polarimeter*. It consists of two parts, one of which is intended to produce a ray of compensation, having a physical character susceptible of numerical expression, and the other to produce polarized bands, or rectilinear isochromatic lines, the extinction of which indicates that the compensation is effected. The details of the construction of the instrument are fully given in the memoir, and numerous experiments made with it, and confirmatory of the author's views, are described.

In conclusion, Sir D. Brewster points out as the general results of his inquiries, as follows:

" 1. The first and most important result of this inquiry is, that it affords a new and independent demonstration of the laws of the polarization of light by reflexion and refraction, given in my papers of 1830. As this result has been already referred to, I shall merely mention the following general proposition.

" When a ray of common light is incident at any angle upon the polished surface of a transparent body, the whole of the reflected pencil suffers a physical change, bringing it more or less into a state of complete polarization; in virtue of which change, its planes of polarization are more or less turned into the plane of reflexion, while the whole of the refracted pencil has suffered a similar, but opposite change, in virtue of which, its planes of polarization are turned more or less into a plane perpendicular to the plane of reflexion.

" 2. As the light of the sky and the clouds is more or less polarized, the employment of the light which they reflect may, in delicate experiments, be a serious source of error, if

we are not aware of its properties. By the principle of compensation, however, we may convert this partially polarized light into common light, and thus make experiments with as great accuracy in the day-time, as we can do with the direct light of a flame. If the light from a particular part of the sky be admitted into a dark room, or otherwise employed, we have only to compensate its polarization either by reflexion or refraction, and employ, as *unpolarized* or *common light*, that part of the light which corresponds with the neutral line.

"3. The laws of the compensation of polarized light enable us to investigate the polarizing structure of the atmosphere, and to ascertain the nature and extent of the two opposite polarizing influences, which I have found to exist in it, and by the compensation of which the neutral points are produced. But, as I shall soon submit to the Society the results of my observations on this subject, I shall not add any thing further at present.

"4. In every case where reflected or refracted light reaches the eye of the observer, whether it comes from bodies near us, or from the primary or secondary planets of our system, the doctrine of compensation enables us to obtain important information respecting the phenomena presented by light thus polarized. The nature of the reflecting or refracting surface, the angles of reflexion or refraction, and the nature of the source of illumination, may, in certain cases, be approximately ascertained.

"5. When the light of the sun, or any self-luminous body, is reflected from the surface of standing water, such as the sea or a lake, it is polarized according to laws which are well known; but when the partially polarized light of the sky (light polarized in every possible plane, passing through the sun and the observer) is reflected, a variety of curious compensations take place, which, when the position of the observer is fixed, vary with the season of the year, and the hour

of the day. In some cases, there is a perfect compensation, the partially polarized light of the sky being restored to common light by the reflection of the water. In other cases the light of the sky has its polarization increased by reflexion from the water in the same plane in which it was itself polarized; and in other cases, the compensation is effected only in particular planes. At sunset, for example, the light reflected from the sea at a great obliquity in two vertical planes inclined 45° to a vertical plane passing through the sun and the observer, is compensated in these two planes, or the plane of its polarization is inclined about 45° to the reflecting surface. The same observations apply to the light of the two rainbows when reflected from the surface of water.

" 6. When the light of the sky, or of the rainbow, is reflected from surfaces not horizontal, such as the roofs of houses, sheets of falling water, or surfaces of smoke and vapour, the compensations are more varied, and a perfect neutralization of the light by the second reflexion is more frequently obtained."

Professor Lloyd mentioned some circumstances which appeared to be opposed to Sir David Brewster's views.

Professor Kane commenced the reading of a paper " on the Tannin of Catechu, and the chemical Substances derived from it."

The abstract of this paper will be printed when the conclusion has been read.

DONATIONS.

Transactions of the Zoological Society of London. Vol. III. Part 1. 1842.

Reports of the Auditors and Council of the Zoological Society of London, April 29th, 1842, *and List of Members.*